

### **REMARKS**

Claims 1-25 are pending in this application. Claims 1, 9, 12, 15 and 21 have been amended. Claims 4, 18, 22 and 25 have been canceled without prejudice. It is respectfully submitted that no new matter has been added.

#### **Rejections under 35 U.S.C § 102/103:**

Claims 1, 2, 4-8, 21, 23 and 25 stand rejected under 35 U.S.C § 102 (e) as being anticipated by Lindley (U.S. Patent 6,326,307). Claims 9, 10, 12, 13 and 22 stand rejected under 35 U.S.C § 103 (a) as unpatentable over Lindley in view of Gabriel (US Patent 6,103,457).

Amended claims 1, 9, 12 and 21 recite, *inter alia*, treating a photoresist pattern with plasma generated by exciting a fluorine-free carbon-containing gas.

Applicants respectfully submit that neither Lindley, Gabriel, nor any combination thereof teaches or suggests the above features.

The Office Action acknowledges that Lindley fails to disclose the above features. For this element, the Office Action relies on Gabriel. The Office Action states that "Gabriel states that a carbon-based plasma may be used in the process instead of a fluorocarbon plasma. It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used a fluorine-free carbon-containing gas, as suggested by Gabriel, in the process of Lindley because Gabriel teaches that this type of gas can create a plasma that works just as well as the fluorocarbon plasma, at protecting the photoresist layer against etching." See page 4 of the Office Action. Applicants respectfully disagree.

Applicants respectfully submit that the carbon-based plasma is not a fluorine – free carbon-containing gas because the carbon-based plasma may include fluorine. For example, in Lindley, CO<sub>2</sub> is used in combination with CH<sub>2</sub>F<sub>2</sub> and C<sub>4</sub>F<sub>8</sub>. See Table 3 of Lindley.

Further, Applicants respectfully submit that there is no suggestion or motivation to combine Gabriel with the cited references. Indeed, Gabriel teaches away from their combination. The Examiner states that there is a motivation to combine the references to protect the photoresist layer against etching. However, in Gabriel, the etching target layer is a metal layer (e.g., aluminum or copper) such that the exposure of the photoresist layer to the carbon-based plasma increases the resistance of the photoresist layer to metal etching plasma (e.g., BCl<sub>3</sub>, Cl<sub>2</sub>, CCl<sub>4</sub>, HCl and SiCl<sub>4</sub>).

In contrast, the etching target layer of the present application and Lindley is a dielectric layer (e.g., SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub>, SiON or ARC layer). In other words, the exposure of the photoresist layer to the fluorine-free carbon-containing gas increases the resistance of the photoresist layer to a dielectric layer etching plasma. Thus, one ordinary skill in the art would not look to Gabriel to protect the photoresist layer from a subsequent plasma etching process targeting a dielectric layer.

Indeed, the nature of the problem to be solved in the references is different from the one in current application. In contrast to the current application, Lindley and Gabriel do use and encourage using fluorine-based plasma in a pretreatment process.

Lindley is directed to a method of reinforcing the durability of a photoresist pattern by sputtering using argon plasma or by treatment process using fluoromethane plasma. Further, Lindley emphasizes the importance of using fluorine-based plasma. For

example, Lindley discloses that “the pretreatment includes difluoromethane ( $\text{CH}_2\text{F}_2$ ), and its presence or that of a similar hydrofluorocarbon is considered crucial for this embodiment in which a protective polymer is formed over both the top of the photoresist layer and in a shoulder extending over the photoresist sidewall.” [Emphasis added].

Gabriel discloses that “the exposure of the photoresist layer to the fluorocarbon plasma increases the resistance of the photoresist layer”. In stark contrast, the present application discloses that “if the gas that provides carbon contains fluorine and is excited to generate plasma, not only carbon radicals but also fluorine radicals are generated. Thus, a polymer layer formed on the photoresist pattern contains fluorine. As a result, fluorine radicals generated in a subsequent etching process may eat away the photoresist pattern through the medium of the fluorine contained in the polymer layer.” *See* paragraph [0037] of the present application.

Accordingly, the Examiner’s reliance on Gabriel to support the rejection under section 103 is misplaced and the rejection of claims 1, 9, 12, and 21 is legally deficient.

Thus, claims 1, 9, 12 and 21 are not rendered obvious by Lindley in view of Gabriel. As claims 2, 5-8, 10, 13, and 23 depend from claims 1, 9, 12 and 21, respectively, they are also not rendered obvious by Lindley in view of Gabriel for at least the above regions. Claims 4, 22 and 25 have been canceled.

Based on the arguments above, reconsideration and withdrawal of the rejection of claims 1, 2, 4-10, 12, 13, 21-22 and 25 under 35 U.S.C § 102(e)/103 (a) is respectfully requested.

Claims 3, 11, 14 and 24 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lindley and Gabriel in view of Ko (U.S. Patent Application 2003/0129816).

As discussed above, Lindley and Gabriel do not disclose treating a photoresist pattern with plasma generated by exciting a fluorine-free carbon-containing gas, as essentially recited in claims 1, 9, 12 and 21.

Ko does not cure the deficiency of Lindley and Gabriel with regard to the above feature. Accordingly, independent claims 1, 9, 12 and 21 are patentable over Lindley and Gabriel in view of Ko. Claims 3, 11, 14 and 24 depend from claims 1, 9, 12 and 21, respectively. Thus, these dependent claims are also patentable for at least the same reasons given for the respective base claims.

Therefore, Applicants respectfully request that the Examiner withdraw the rejections of claims 3, 11, 14 and 24 under 35 U.S.C. 103(a) and claims 3, 11, 14 and 24 are in condition for allowance.

Claims 15-20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lindley in view of Gabriel and further in view of Ma (U.S. Patent 6,830,877).

Claim 15 recites, *inter alia*, treating a photoresist pattern with plasma generated by exciting a fluorine-free carbon-containing gas. As discussed above, neither Lindley, Gabriel, nor any combination thereof teaches or suggests the above feature.

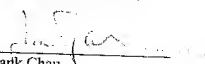
Ma does not cure the deficiency of Lindley and Gabriel with regard to the above feature. Accordingly, claim 15 is patentable over Lindley and Gabriel in view of Ma.

Claims 16-20 depend from claim 15. Thus, claims 16, 17, 19 and 20 are also patentable for at least the same reasons given for claim 15. Claim 18 has been canceled.

Therefore, Applicants respectfully request that the Examiner withdraw the rejections of claims 16-20 under 35 U.S.C. 103(a) and claims 16, 17, 19 and 20 are in condition for allowance.

For the foregoing reasons, the present application is believed to be in condition for allowance. The Examiner's early and favorable action is respectfully requested. The Examiner is invited to contact the undersigned if he has any questions or comments in this matter.

Respectfully submitted,

  
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